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Auditable Safety Analysis

TAN-607A

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

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CONTENTS

TABLES

ACRONYMS

ASA	auditable safety analysis
DOE	Department of Energy
DOE-ID	Department of Energy – Idaho Operations
DU	depleted uranium
HEPA	high efficiency particulate air
HVAC	heating, ventilation, and air conditioning
INEEL	Idaho National Engineering and Environmental Laboratory
MDF	Materials Development Facility
OSR	operational safety requirements
RBA	Radiological Buffer Area
RCM	Radiological Control Manual
RCRA	Resource Conservation and Recovery Act
RQ	Reportable Quantity
SAA	Satellite Accumulation Area
SAR	Safety Analysis Report
SMC	Specific Manufacturing Capability
TAA	Temporary Accumulation Area
TAN	Test Area North
TANO	Test Area North Operations
USQ	unreviewed safety question
WGS	Waste Generator Services'

E. EXECUTIVE SUMMARY

E.1 Facility Background and Mission

The Test Area North (TAN) Materials Development Facility (MDF) in TAN-607A was used to provide research and development support to the Specific Manufacturing Capability (SMC) project. Its mission supported the identification, evaluation, and development of manufacturing processes and materials for SMC. Since this mission is no longer necessary, TAN-607A has been restored to a condition that will allow future missions to use the facility areas.

E.2 Facility Overview

This document describes TAN-607A, which includes TAN-686 (double-wide trailer) and TAN-694, which houses waste tank TK-GA-102. Waste tank TK-GA-103 is in an underground vault adjacent to TAN-694. The unreviewed safety question (USQ) process will be used to determine the level of approval required for proposed new activities.

E.3 Facility Hazard Classification

Based upon DOE-ID orders O 420.C and O 420.D and DOE standards 1027-92 and 5502-94, the restoration of TAN-607A was classified as a low hazard radiological facility that required an auditable safety analysis (ASA), but did not require Department of Energy Idaho Operations Office (DOE-ID) approval. The present condition of TAN-607A would allow the facility to be reclassified as non-nuclear, but reclassification of the facility will not be done at this time. This will allow new activities within TAN-607A to introduce radioactive material as long as the inventory of radionuclides does not exceed the quantities allowed for a radiological facility.

E.4 Safety Analysis Overview

The hazard and accident analysis of TAN-607A restoration activities did not identify any accidents that require additional controls other than the application of in-place administrative programs such as the radiological protection program. New activities will be evaluated on a case-by-case basis (e.g., through the use of the USQ process) to ensure that activities remain within the bounds of this safety basis.

E.5 Organizations

The management and operating contractor for Test Area North Operations (TANO) is responsible for activities conducted in TAN-607A.

E.6 Safety Analysis Conclusions

The safety analysis of TAN-607A restoration activities demonstrates that protection of public and worker health and safety and of the environment is acceptable.

E.7 SAR Organization

This safety analysis of the ongoing restoration activities and new activities at TAN-607A addresses the 21 Safety Analysis Report (SAR) topics required by DOE Order 5480.23 and is organized in a 17-chapter format that follows the guidelines of DOE-STD-3009-94. A number of the chapters in this safety analysis reference the Idaho National Engineering and Environmental Laboratory (INEEL) SAR (i.e., SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters*) for information applicable to various institutional safety programs.

1. SITE CHARACTERISTICS

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

2. FACILITY DESCRIPTION

2.1 Introduction

This chapter provides descriptive information concerning TAN-607A, which is the southern third of TAN-607. Descriptions of TAN-607A and its previous mission (i.e., the Materials Development Facility for the Specific Manufacturing Capability Project) are included to aid in determining the potential inventory of both radiological and hazardous materials that may reside within the facility. Various other facility features are also described.

2.2 Facility Overview

TAN-607A, formerly named the Materials Development Facility (MDF) was used to provide research and development support to the Specific Manufacturing Capability (SMC) project located at the INEEL. The mission was to support the identification, evaluation, and development of manufacturing processes and materials for SMC. Since this mission has been moved, TAN-607A is being restored into a condition that will allow future missions to use the facility areas. The TAN-607A facility includes the various rooms and labs within TAN-607A, TAN-686 (the double-wide trailer that houses offices, locker room, restrooms, and RadCon office) and TAN-694 (a concrete block building that houses an 18,930-L [5000-gal] liquid waste tank, TK-GA-102) and an associated 3785-L (1000-gal) underground liquid waste tank, TK-GA-103. This tank is under the roadway leading to the east side of TAN-607.

2.2.1 TAN-607A

TAN-607A is a concrete block structure that is approximately 45.7 m (150 ft) wide and 87.2 m (286 ft) long. The entire facility contains insulation (e.g., transite, pipe insulation) with asbestos. The asbestos is not friable unless disturbed. The high-bay portion is about 20.7 m (68 ft) high and the remainder of TAN-607A is about 11.6 m (38 ft) high. TAN-607A is divided into three major portions, which were referred to as the Heating, Ventilation, and Air Conditioning (HVAC) room (140), the Machine Shop (149), and the High Bay (158 and adjacent rooms).

The HVAC room 140 is about 39.3 m (129 ft) wide and 21.3 m (70 ft) long and consists of a room built within the original room 140. This area contains ventilation equipment and is not radiologically contaminated.

The Machine Shop, room 149, has roughly the same dimensions as room 140, and contains machining equipment needed to fabricate specialized parts. The Machine Shop is not contaminated. To the east of the Machine Shop are a breakroom, computer work stations, and a storage area. The tool crib (Room 149B) is located in the southwest corner of the Machine Shop and is not contaminated. Further to the east are rooms 150, 150A, and 151,which have been restored and currently contain offices. To the south of these rooms is room 156, which has been converted from a gauging laboratory to offices, and room 157, which is a laboratory containing gloveboxes. Both rooms 156 and 157 contain fixed contamination.

The High Bay, room 158, is about 39.3 m (129 ft) wide and 41.1 m (135 ft) long and includes several smaller rooms. These smaller rooms are 153, 154, and 156. The High Bay contains a pit below the four-railroad-track area near the truck entry. This pit is also referred to as the locomotive pit and has been filled with concrete and welded closed with a steel plate. The High Bay is a radiological buffer area (RBA), contains fixed contamination, and is posted as having "Possible Contamination in the Overhead." The posting "Possible Contamination in the Overhead" implies that rooms with possible loose contamination were not wiped down above the 2.44 m (8 ft) level during restoration activities. Rooms 153, 154, and 156 contain fixed contamination. The mezzanine above room 154 is an RBA and is accessed by stairs in Room 153. The wall between Room 153

and the High Bay is only about half the height of the ceiling, and above this wall is a canvas curtain that can be opened and closed. The mezzanine area is also open to the High Bay and Room 153. All of the equipment in these rooms has been removed.

Room 159, which is an RBA with "Possible Contamination in the Overhead," is about 7.3 m (24 ft) wide and 11.0 m (36 ft) long and was used to decontaminate various parts prior to their movement out of the high bay area. Adjacent to this room is a change room (room 160) and adjacent to room 160 is an unnumbered fan room. Both the fan room and room 160 contain fixed contamination, and the fan room also contains contaminated ducts.

Room 161 is about 21.3 m (70 ft) wide and 11.0 m (36 ft) long and is an RBA with fixed contamination and "Possible Contamination in the Overhead." It was used to degrease various parts and has a degreasing pit that collected various low-level contaminated by-product materials from the degreasing operations. The degreasing pit is now filled in with concrete.

Room 162 is about 9.4 m (31 ft) wide and 11.0 m (36 ft) long and was used to clean parts that were corroded or required more cleaning. A pit in this area was used to recycle sand that was used in the cleaning process. The pit has been covered with a carbon steel plate, with the cleaning equipment and sand removed from the area. The Ducrete Project and "work-for-others" were located in this area. The Ducrete Project was to determine the feasibility of encasing depleted uranium (DU) in concrete. As a result, room 162 contained about 1488 kg (3280 lb) of DU in drums. The DU was in three oxide forms: UO_3 (1265 kg, [2789 lb]), U_3O_8 (93.0 kg [205 lb]), and UO_2 (129.7 kg [286 lb]). All equipment and the DU-bearing drums have been removed, but the area still has fixed contamination and "Possible Contamination in the Overhead." The area is now a radiological area where radioactive wastewater from the Heated Vacuum Drying System is stored in 55-gallon drums (i.e., approximately 208 L per drum).

2.2.2 TAN-694

TAN-694 is a small extension added to the southeast corner of TAN-607A about 5.49 m (18 ft) wide and 9.91 m (32.5 ft) long that contains an aboveground 18,930-L (5000—gal) tank (TK-GA-102). TK-GA-102 collected wastewater from various laboratory areas. The wastewater could be directed to TK-GA-103 and returned after the wastewater was treated. Liquid wastewater could also be pumped from TK-GA-102 into a transport truck and shipped elsewhere. This tank was 63% filled (i.e., about 11,920 L [3150 gal] of wastewater) and has been pumped down as low as possible. This wastewater contained DU, as well as chemical residues from various tests that were conducted.

TAN-694 has an associated 3785 L (1000 gal) underground tank, TK-GA-103, which is located about 8.23 m (27 ft) east of TK-GA-102. Tank TK-GA-103 was about 35% full (i.e., about 1325 L [350 gal] of wastewater), but has been pumped down as low as possible. TK-GA-103 was used to treat wastewater from TK-GA-102 and then recycle the waste back to TK-GA-102. Thus, the wastewater in TK-GA-103 is expected to have chemical residues and DU contamination similar to TK-GA-102.

2.3 Historical Process Description

The previous mission of TAN-607A was to support SMC production through research, development, and analytical testing activities to enhance the final product quality. TAN-607A processes involved DU containing no greater than 0.400 wt% U-235. The following sections describe some of the processes that were performed. Even though much of the machinery has been removed from TAN-607A, the processes that were performed are still described to support estimating the inventory of radiological and hazardous materials that may remain in the facility ducts and on other facility structures.

2.3.1 TAN-607A Historical Processes

The fabrication area within TAN-607A contained the necessary equipment to produce finished DU assemblies and material testing equipment. DU was received and stored in shipping containers in a designated control zone. Other materials were received and stored as needed for testing or manufacturing assemblies. The DU was unpackaged and moved as needed to various work stations.

The fabrication area contained equipment such as a rolling mill, a salt bath for preheating, a shear, and punches to fabricate parts and test specimens. A CO_2 gas laser, a vacuum furnace, and an inert gas furnace were also present. TAN-607A also had a standard industrial shop and a specialty machine shop that prepared sample specimens for study in the analytical laboratory. A small furnace was used to oxidize pyrophoric DU fines and turnings. All scrap was collected and stored until it could be removed from the facility.

The analytical laboratory was used to evaluate test materials for both chemical and mechanical properties. Analyses that used toxic or hazardous materials were performed in ventilated exhaust hoods.

Stainless steel enclosures for DU assemblies were also fabricated using punch presses, sheet metal brakes, a CO_2 gas laser, and tungsten inert gas welders.

2.3.2 TAN-607A Restoration

The restoration of TAN-607A began following removal of the manufacturing and laboratory equipment.[1] Equipment utility drops have been removed to a nearby wall or other reasonable location. Utilities have clean disconnections to allow other projects to easily reconnect them. The ventilation system branches to individual work stations have been removed, leaving the main ductwork branches, filter housings, filters, and the exhaust stack in place. Portable offices have been removed, but none of the main features of the building floor plan have been altered.

Low-level contamination is present in the high bay (Room 158), adjacent rooms (Rooms 153, 154, and 161), and in the laboratory areas. Radiological personnel inspected the areas to determine the actual contamination levels, and decontamination efforts used Butcher's Speedball Power Cleaner, commercially available, to reduce contamination to the DOE Order 5400.5[2] levels of 1000 dpm/100 cm^2 for removable contamination and 5000 dpm/100 cm^2 for the average total contamination. Areas that could not be decontaminated to levels within the acceptance criteria using normal methods were "sand blasted" using steel shot to remove a thin layer of the contaminated surface. The steel shot was collected and removed from the facility. Some areas that could not be decontaminated were painted and identified as fixed contamination, or posted for loose contamination above the 2.44-m (8-ft) level with signs reading "Possible Contamination in the Overhead."

Various "hot spots" are located in laboratory floor drains and laboratory fume exhaust hood ductwork. The drains from some sinks in the laboratory are under the floor. Contaminated drains that could not be decontaminated were sealed and the drain openings identified. The laboratory hoods and ductwork have been removed. Contaminated areas have been painted and identified as fixed contamination.

2.3.3 Cask Dismantlement

The high bay, room 158, is used to disassemble and characterize lead or uranium shielded casks. Waste containers are used to package low-level radioactive and mixed waste. These packages are also staged in the high bay.

Casks are transported into the high bay on transport trailers and are off-loaded using the high bay 75-ton bridge crane. External cask components that do not contain lead or uranium (shielding components) are removed,

sized, and prepared for disposal. Additional disassembly will be performed as needed to allow access to the cask interior for radiological measurements and samples.

2.3.4 Repackaging Operations

Room 161 in TAN-607A will be used to package or sort and repackage low-level waste, mixed waste, and clean lead. Packages are moved into the assembly area using forklifts or the bridge crane. These packages are opened, sampled, and characterized. The contents are sorted according to the various waste stream acceptance criteria.

2.3.5 Floor Loading in TAN-607A

In order to perform the functions described above, heavy components such as casks must be transported into the facility. Floor loads in three different areas of TAN-607A (i.e., Rooms 158, 159, and 161) were examined to determine the effect of these heavy loads on the concrete floors.[3] As a result of these analyses, restrictions on transport vehicle routes and load placement have been established for these three rooms. The restrictions in reference 3 are based on specific casks and handling equipment, and in some cases take into account the diameter of the cask, the number of axles, the spacing between wheels on each axle, and tire pressure. A summary of the restrictions placed on heavy load handling activities in TAN-607A are as follows:

1. Room 158
   a. An 11,340-kg (25,000-lb) trailer with a 30,390-kg (67,000-lb) cask may be backed into the High Bay while straddling the south set of railroad tracks without damage to the floor.
   b. A cask weighing up to 19,500 kg (43,000 lb) and its lid weighing up to 9980 kg (22,000 lb) may be placed on the floor in any one of three areas at the east end of the High Bay, if separated by a minimum of 3.66 m (12 ft).
   c. A loaded trailer or cask should not be placed over the steel Assembly Pit Cover.
2. Room 161
   a. A 4900-kg (10,800-lb) forklift with a 3630-kg (8000-lb) load may be used in the room without damaging the floor.
   b. A 55-gallon barrel (i.e., approximately 208 L) weighing 680 kg (1500 lb) is the most concentrated load expected in Room 161. This loading will not damage the floor.
3. Room 159
   a. The use of a 16,330-kg (36,000-lb) forklift (e.g., a Yale Model GDP360EA) to carry a 7710-kg (17,000-lb) cask could result in floor damage.
   b. Floor damage will not occur if a cask weighing up to 1710 kg (17,000 lb) is placed in the room using the overhead crane.

Since the calculations in Reference 3 are load and equipment specific, other combinations of loads and equipment will be evaluated on a case by case basis, and additional restrictions will be added, as needed.

2.4 Confinement Systems

TAN-607A was constructed in the 1950s and design information is not readily available. The building structure was not needed to protect workers from radiation, but is needed from an industrial standpoint. The building is used to support cranes and their loads.

Personnel were protected from airborne contamination generated during the MDF fabrication processes, by the ventilation system. The ventilation system creates differential pressure conditions that direct the flow of gaseous effluent and particulates away from workers and to the high-efficiency particulate air (HEPA) filters. Although most equipment has been removed from TAN-607A, the ventilation system remains operable.

The exhaust system consists of certified HEPA filters. In-place dioctylphthalate smoke testing was performed periodically. Prefilters and certified HEPA filters are housed in a filter bank containing from 6 to 12 filters in an array of 2 × 3 or 3 × 4. Effluent from the filter bank is released to the atmosphere through a stack.

The ventilation system ductwork has been cleaned and removed from the interior of the building areas to the exterior walls. Some residual contamination remains within the ducts that have not been removed, but has been stabilized as needed according to the radiological program.

2.5 Safety Support Systems

Safety support systems include various systems and depend on the work evolution involved. The ventilation system might be relied on to ensure that airborne contaminates remain at a minimum level during future activities. The proper safety support systems that ensure personnel are not unduly exposed to radioactive or hazardous materials will be determined as needed through in-place programs such as the radiological protection and industrial hygiene programs.

2.6 Utility Distribution Systems

The following utility systems are provided in TAN-607A:

- Electrical distribution
- Fire system
- Water service
- Sanitary sewer
- Telephone service
- Computer connections.

2.7 Auxiliary Systems and Support Facilities

TAN-607A requires support from INEEL facilities and Test Area North Operations (TANO). Supporting facilities include waste storage, treatment and disposal facilities, personnel support facilities for sanitation, staging areas, and offices. Services required in support of TAN-607A include fire protection, security, emergency response personnel and equipment, and transportation of radioactive, hazardous, and solid waste.

Supporting facilities and services may also include:

- Radio communications
- Fire department

- Portable air supplies
- Emergency egress considerations
- Confined space testing
- Underground utility locating services.

2.8 References

1. Lockheed Martin Idaho Technologies Company, *Project Execution Plan for the TAN 607A Equipment Removal and Facility Restoration Project*, SMC-RPT/048, Rev. 0, January 1999.

2. DOE Order 5400.5, "Radiation Protection of the Public and Environment," U. S. Department of Energy, Change 2, January 7, 1993.

3. Idaho National Engineering and Environmental Laboratory, Engineering Design File 1473 (EDF 1473), "TAN-607A Concrete Floor Calculations," Rev. 1, July 25, 2000.

3. HAZARD AND ACCIDENT ANALYSIS

3.1 Introduction

This chapter presents the methodology and results of the hazards analysis of the activities conducted in TAN-607A. From the hazards analysis, representative, unique, and/or bounding accidents requiring further analysis are selected, and results of the accident analysis are presented.

3.2 Requirements

Guidance on performing hazard analysis, determining the hazard classification, and developing accident analysis can be found in the following:

DOE Order 5480.23, "Nuclear Safety Analysis Reports"[1]

DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports"[2]

DOE-STD-3009-94, "Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports"[3]

For facilities that have inventories of radiological or hazardous materials less than the threshold criteria in the above stated references, the following documents should be used:

DOE-STD-5502-94, "Hazard Baseline Documentation"[4]

DOE-ID Order 420.C, "Safety Basis Review and Approval Process."[5]

DOE-ID Order 420.D, "Requirements and Guidance for Safety Analysis."[6]

3.3 Hazards Analysis

3.3.1 Methodology

The methodology used to identify and evaluate potential hazards to workers, members of the public, and the environment from activities in TAN-607A is described in the following subsections and is consistent with the requirements listed in Section 3.2.

3.3.1.1 Hazard Identification

Standardized checklists of potential hazardous materials and energy sources and occupational hazards were used to support and document the identification of hazards and to ensure completeness. Hazards were identified through discussions with personnel, review of historical records for similar activities, and a walkdown of the facility and similar facilities.

3.3.1.2 Hazard Evaluation

Activities in TAN-607A have been analyzed in accordance with INEEL procedures and the DOE documents listed above. Hazards associated with TAN-607A activities have been evaluated and are identified below. New activities will be evaluated on a case-by-case basis.

3.3.2 Hazard Analysis Results

3.3.2.1 Hazard Identification

The following hazards have been evaluated:

- Criticality
- Fire
- Radiological issues
- Hoisting and rigging
- Hazardous chemicals.

3.3.2.2 Hazard Classification

Hazard classification of TAN-607A follows the guidance presented in DOE-STD-1027-92 and LA-12981-MS,[7] DOE-STD-5502-94, and DOE ID O 420.D. The amount of radioactive material remaining in TAN-607A has been estimated based on samples taken from within the ventilation ductwork and the area of ductwork remaining in the facility.[8,9] Visual inspections of the accessible interior portions of the ductwork shows that material has accumulated on the vertical surfaces, but not on the horizontal surfaces. The following inventory estimates assume that material has accumulated on the duct surfaces and is distributed uniformly.

TAN-607A rooms 158, 161, 162, and 153 are estimated to contain 319 m^2 (3430 ft^2), 83.6 m^2 (900 ft^2), 26.0 m^2 (280 ft^2), and 39.0 m^2 (420 ft^2) of ductwork, respectively. Most of this ductwork has been removed, but will be included in the facility inventory for facility classification to ensure that any contamination introduced on casks in the future is bounded. Radioactive material located on various surfaces within TAN-607A is estimated to be very small because of radiological monitoring in conjunction with exhaust hoods that were located at each work station. Table 1 provides a summary of the inventory of radionuclides in the TAN-607A facility along with the Hazard Category 3 threshold for each isotope. The inventory quantities listed in Table 1 are conservatively high for classification of the facility. In reality, tanks TK-GA-102 and TK-GA-103 have been pumped out and the Ducrete in room 162 has been removed. Also provided in the table is the ratio of the inventory divided by the threshold quantity, and finally the sum of the ratios. If any one isotope exceeds the Category 3 threshold quantity or the sum of the ratios is greater than one, then the facility is a nuclear facility. Even when including the radionuclide inventory of the Ducrete and the two tanks before pumping, the sum of the ratios is less than one, so the facility is not a nuclear facility, and DOE-STD-5502-94 must be used to classify the facility.

DOE-STD-5502-94 is used to determine the non-nuclear classification of the facility and the appropriate level of approval required for the safety document. DOE-STD-5502-94 requires a comparison of the releasable radionuclide inventory in the facility to the reportable quantities (RQs) in the radionuclide table in 40 CFR 302.4, Appendix B. Shown in Table 2 is the inventory of radioactive materials currently estimated to be in TAN-607A including the Ducrete and two tanks. Also included in Table 2 is the ratio of the inventory divided by the RQ, and at the bottom of the table is the sum of the ratios. If any one isotope exceeds its RQ, as listed in 40 CFR 302.4, Appendix B, or the sum of the ratios is greater than one, then the facility is a radiological facility. Since the U-238 inventory in Room 162 exceeds the reportable quantity, TAN-607A is classified as a radiological facility. Note, the inventory listed in Table 2 is conservative and the present inventory is no longer large enough to require TAN-607A to be classified as a radiological facility; however, this is a conservative classification and will not be changed at this time.

Table 1. TAN-607A Radiological Inventory Estimates

Isotope	Inventory (g)	DOE-STD-1027-92 Hazard Category 3 Threshold (g)	Ratio (Inventory/Threshold)
Ductwork**			
Tc-99	3.320E-5	1.0E+5	3.32E-10
Pa-234	1.430E-9	7.6E-4*	1.88E-6
Th-234	1.237E-7	1.2E-1*	1.03E-6
U-234	5.974E-2	6.7E+2	8.92E-5
U-235	3.405E+1	1.9E+6	1.79E-5
Np-237	2.660E-4	6.0E+2	4.43E-7
Pu-238	8.740E-9	8.4E+0	1.04E-9
U-238	8.479E+3	1.3E+7	6.52E-4
Pu-239	4.870E-6	1.5E-1	3.25E-5
Am-241	9.270E-8	3.6E-2	2.57E-6
Room 162 (Ducrete)**			
Tc-99	6.530E-3	1.0E+5	6.53E-8
U-235	5.957E+3	1.9E+6	3.14E-3
Np-237	7.210E-4	6.0E+2	1.20E-6
Pu-238	4.610E-4	8.4E+0	5.49E-5
U-238	1.483E+6	1.3E+7	1.14E-1
Pu-239	1.880E-3	1.5E-1	1.25E-2
Am-241	2.070E-3	3.6E-2	5.75E-2
TAN-694			
TK-GA-102 (0.32 µg U/g)**			
Tc-99	1.670E-8	1.0E+5	1.67E-13
U-235	1.527E-2	1.9E+6	8.04E-9
Np-237	1.850E-9	6.0E+2	3.08E-12
Pu-238	1.180E-9	8.4E+0	1.41E-10
U-238	3.801E+0	1.3E+7	2.92E-7
Pu-239	4.810E-9	1.5E-1	3.21E-8
Am-241	5.310E-9	3.6E-2	1.47E-7
TK-GA-103 (7.50 µg U/g)**			
Tc-99	4.480E-8	1.0E+5	4.48E-13
U-235	4.089E-2	1.9E+6	2.15E-8
Np-237	4.950E-9	6.0E+2	8.25E-12
Pu-238	3.170E-9	8.4E+0	3.77E-10
U-238	1.018E+1	1.3E+7	7.83E-7
Pu-239	1.290E-8	1.5E-1	8.59E-8
Am-241	1.420E-8	3.6E-2	3.95E-7
		Sum of the ratios	1.88E-1

* These values taken from J. Clow, J. Elder, G. Heindel, W. Inkret, G. Miller, *Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 List of 757 Radionuclides*, LA-12981-MS, Los Alamos National Laboratory, August 1995.

** The Ducrete and most of the ductwork have been removed, and tanks TK-GA-102 and TK-GA-103 have been pumped out, so the majority of the radionuclide inventory has been removed from the facility.

Table 2. 40 CFR 302.4 Reportable Quantities (RQ) of Radionuclides

Isotope	Inventory (Ci)	RQ of Radionuclides (Ci)	Ratio of Inventory to RQ
TAN-607A			
Ductwork*			
Tc-99	5.64E-7	1.0E+1	5.64E-08
Pa-234	2.87E-3	1.0E+1	2.87E-04
Th-234	2.87E-3	1.0E+2	2.87E-05
U-234	3.78E-4	1.0E-1	3.78E-03
U-235	1.14E-5	1.0E-1	1.14E-04
Np-237	1.87E-7	1.0E-2	1.87E-05
Pu-238	1.50E-7	1.0E-2	1.50E-05
U-238	2.85E-3	1.0E-1	2.85E-02
Pu-239	3.02E-7	1.0E-2	3.02E-05
Am-241	3.18E-7	1.0E-2	3.18E-05
Room 162 (Ducrete)*			
Tc-99	9.86E-5	1.0E+1	9.86E-06
U-235	1.30E-2	1.0E-1	1.30E-01
Np-237	3.28E-5	1.0E-2	3.28E-03
Pu-238	2.62E-5	1.0E-2	2.62E-03
U-238	4.98E-1	1.0E-1	4.98E-00
Pu-239	5.29E-5	1.0E-2	5.29E-03
Am-241	5.55E-5	1.0E-2	5.55E-03
		TAN-607A Ratio Total	5.16E-00
TAN-694			
TK-GA-102 (0.32 µg U/g)*			
Tc-99	2.53E-10	1.0E+1	2.53E-10
U-235	3.38E-8	1.0E-1	3.38E-07
Np-237	8.40E-11	1.0E-2	8.40E-09
Pu-238	6.72E-11	1.0E-2	6.72E-09
U-238	1.28E-6	1.0E-1	1.28E-05
Pu-239	1.35E-10	1.0E-2	1.35E-08
Am-241	1.42E-10	1.0E-2	1.42E-08
TK-GA-103 (7.50 µg U/g)*			
Tc-99	8.77E-10	1.0E+1	8.77E-11
U-235	9.04E-8	1.0E-1	9.04E-07
Np-237	2.25E-10	1.0E-2	2.25E-08
Pu-238	1.80E-10	1.0E-2	1.80E-08
U-238	3.42E-6	1.0E-1	3.42E-05
Pu-239	3.63E-10	1.0E-2	3.63E-08
Am-241	3.81E-10	1.0E-2	3.81E-09
		TAN-694 Ratio Total	4.84E-05

* The Ducrete and most of the ductwork have been removed, and tanks TK-GA-102 and TK-GA-103 have been pumped out, so the majority of the radionuclide inventory has been removed from the facility.

A radiological facility is required to have the following:

- An auditable safety analysis (ASA)
- An evaluation of the releasable non-radioactive hazardous materials to determine the hazard classification of the facility, which is summarized in the ASA
- Approval of the ASA by DOE-ID, if the facility is a moderate or high hazard facility per DOE-ID O 420.C (see Reference 5).

Only commercially available cleaners, such as Butcher's Speedball Power Cleaner, were used for decontamination and restoration activities. The most hazardous constituents of this cleaner are (1) up to 7% 2-butoxy ethanol and (2) up to 3% monoethanolamine.[10] Neither of these chemicals is listed in either 29 CFR 1910.119 or 40 CFR 355. Hazardous cleaners may be used in TAN-607A, provided the amount of hazardous material in the cleaner does not exceed either 29 CFR 1910.119 or 40 CFR 355 levels.

Table 3 shows the hazardous materials listed in either 29 CFR 1910.119 or 40 CFR 355 that existed in the two wastewater tanks, TK-GA-102 and TK-GA-103, before they were pumped down. Also listed in Table 3 is the inventory of metals in TAN-607A and the two waste tanks that are listed in the Resource Conservation and Recovery Act (RCRA). Most of the metals are not listed in 29 CFR 1910.119 or 40 CFR 355, but have an RQ listed in 40 CFR 302.4, which is also shown in Table 3. These inventories are based on 1993 samples[11,12] and are assumed to be representative of waste that would have been collected since 1993.

DOE-ID Order 420.D is used to determine the hazardous material classification (i.e., high, moderate, or low) of a facility and the level of approval (i.e., DOE-ID or contractor) needed for the safety document.

A low hazard classification is associated with a facility that:

1. Could not have the potential personnel radiation exposure from sealed radioactive sources, radiation-producing devices, or non-releasable radioactive material in excess of a total effective dose equivalent of 2 rem from a single event.
2. Could not have material at risk quantities of hazardous materials that meet or exceed the 29 CFR 1910.119 threshold quantities or the 40 CFR 355 threshold planning quantities (if the hazardous material is not listed in 29 CFR 1910.119).
3. Could not potentially result in injury to more than five (5) people onsite from a single event.
4. Could not potentially result in any risk to the offsite public.
5. Could not potentially result in any environmental perturbations other than those that are temporary and totally restorable in nature, thereby resulting in no environmental impact.

Table 1 shows the DOE-STD-1027-92 threshold quantities for Hazard Category 3 classification. These values are less than those given by DOE-STD-1027-92 for Hazard Category 2, which are based on an exposure to personnel in the range of 1 rem, 100 m (328 ft) from the release. Since TAN-607A has an inventory much less than Hazard Category 3 quantities, which are roughly 100 times less than Hazard Category 2 thresholds, the complete release of the radionuclide inventory in TAN-607A will result in exposures to personnel less than 1 rem. Therefore, the first criterion above is met.

Table 3. Hazardous Constituent Inventory

Material (mg/L)	Inventory (lb)	40 CFR 302.4 RQ Quantity (lb)	29 CFR 1910.119 Threshold Quantity (lb)	29 CFR 355, Appendix A	
				RQ (lb)	Threshold Planning Quantity (lb)
TAN-607A					
Lead	150,000	10*	NA	NA	NA
TAN-694					
TK-GA-102					
Chloroform(<0.005)	<1.3E-4	10	NA	10	10,000
Arsenic (<0.010)	<2.6E-4	1*	NA	NA	NA
Barium (0.14)	3.7E-3	NA	NA	NA	NA
Cadmium (0.053)	1.4E-3	10*	NA	NA	NA
Chromium (0.27)	7.1E-3	5000*	NA	NA	NA
Lead (0.046)	1.2E-3	10*	NA	NA	NA
Mercury (0.0058)	1.5E-4	NA	NA	NA	NA
Selenium (<0.010)	<2.6E-4	100*	NA	NA	NA
Silver (<0.010)	<2.6E-4	1000*	NA	NA	NA
TK-GA-103					
Chloroform (<0.005)	<1.3E-4		NA	10	10,000
Ethanol (0.14)	4.2E-4	NA	NA	NA	NA
Arsenic (<0.010)	3.0E-5	1*	NA	NA	NA
Barium (0.25)	7.5E-4	NA	NA	NA	NA
Cadmium (0.050)	1.5E-4	10*	NA	NA	NA
Chromium (0.55)	1.7E-3	5000*	NA	NA	NA
Lead (0.1)	3.0E-4	10*	NA	NA	NA
Mercury (0.0043)	1.3E-5	NA	NA	NA	NA
Selenium (<0.010)	3.0E-5	100*	NA	NA	NA
Silver (<0.020)	6.0E-5	1000*	NA	NA	NA

* No reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 100 μm (0.004 in.).

Table 3 shows that the inventory of hazardous materials and RCRA-listed metals is well below reportable quantities, except for lead in TAN-607A. This lead, however, is not in a releasable form (i.e., particle sizes less than 100 μm or 0.004 in.), and so is not reportable per 40 CFR 302.4. Additional hazardous materials are not expected to be introduced into TAN-607A; therefore, 29 CFR 1910.119 or 40 CFR 355 thresholds will not be exceeded, thus satisfying item 2, above.

The use of industrial cleaners is a commonly accepted workplace hazard, and the safe use of these cleaners is covered by the manufacturer's instructions for use and by Occupational, Safety, and Health Act regulations. Therefore, items 3, 4, and 5, above, are satisfied, and TAN-607A can be classified as a low hazard facility.

Prior to bringing hazardous or other radiological materials into TAN-607A, the allowed quantities will be checked to be less than the above cited threshold levels to ensure the hazard categorization remains the same (see Chapter 5, "Derivation of Administrative Safety Requirements"). Hazardous or other radiological materials greater than the threshold levels are not allowed and will be administratively controlled through procedures. Therefore, TAN-607A is classified as a low hazard radiological facility. DOE-ID has approved this hazard categorization of TAN-607A,[13] and since the hazard classification of the facility will not be changed at this time, DOE-ID approval of this ASA is not required.

3.3.2.3 Hazard Evaluation

The hazard types and sources identified for TAN-607A consist of those identified in Section 3.3.2.1. No non-routine hazards are present except for radiation exposure to workers. Radiation protection during normal operations is addressed in Chapter 7. The hazards identified in Section 3.3.2.1 are discussed below.

3.3.2.3.1 Criticality

TAN-607A does not pose a criticality hazard because the material that was in the facility was DU enriched to no more than 0.400 wt%. Natural uranium is composed of about 0.7% U-235 and cannot be made critical without a special form of neutron moderation and special geometry. The only possible source of fissile or radioactive material that could be brought into TAN-607A in the future will be limited to the contamination on equipment brought into the facility for processing. Therefore, an inadvertent criticality hazard does not exist in TAN-607A.

3.3.2.3.2 Fire

The facility is equipped with an overhead wet sprinkler system. In addition, portable, hand-held, fire extinguishers are available within the facility for use. No bulk chemical storage is allowed in the facility unless the materials are evaluated prior to storage to show that there is no increased fire hazard. Any flammable, corrosive, or otherwise hazardous materials used or stored in the facility are in accordance with the fire hazards analysis and company procedures.[14] DU metal is pyrophoric in particulate form. However, the material in the ducts has been entrained in air (i.e., particulate) and thus would have already reacted to a non-pyrophoric oxide form prior to its deposition in the ducts. Combustibles are controlled in accordance with company procedures. Fires, therefore, are expected to be minimal and will not cause significant personnel or environmental hazards. If a fire did occur, it would cause damage primarily to the facility.

3.3.2.3.3 Hoisting and Rigging

The overhead cranes were used in the facility for placement of equipment and movement of heavy loads. These cranes will be operated in accordance with procedures that comply with the requirements of the DOE Hoisting and Rigging Standard.[15]

3.3.2.3.4 Hazardous Chemicals

The quantities of hazardous chemicals present in the facility are normally limited to small containers and are below the threshold quantities defined in 29 CFR 1910.119 or 40 CFR 355. Chemicals and other hazardous materials are handled in accordance with company procedures for storage, handling and disposal of hazardous chemicals. Prior to bringing hazardous materials into TAN-607A for new activities, the unreviewed safety question (USQ) process will be performed in accordance with company procedures.

3.3.2.3.5 Radiological Issues

Radiological safety in the facility is addressed by the INEEL Radiological Control Manual (RCM).[16] Please refer to Chapter 7 of SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*

3.3.2.3.6 Floor Loading

Note, a cracked floor is not a safety concern that requires a specific evaluation of the consequences because no accident analyses take credit for the floor preventing a release of radioactive or hazardous material.

3.4 References

1. DOE Order 5480.23, "Nuclear Safety Analysis Reports," U.S. Department of Energy, April 1992.

2. DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," U.S. Department of Energy, December 1992.

3. DOE-STD-3009-94, "Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports," U.S. Department of Energy, July 1994.

4. DOE-STD-5502-94, "Hazard Baseline Documentation," U.S. Department of Energy, August 1994.

5. DOE-ID Order 420.C, "Safety Basis Review and Approval Process," U.S. Department of Energy, Idaho Operations Office, July 17, 2000.

6. DOE-ID Order 420.D, "Requirements and Guidance for Safety Analysis," U.S. Department of Energy, Idaho Operations Office, July 17, 2000.

7. J. Clow, J. Elder, G. Heindel, W. Inkret, G. Miller, *Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 List of 757 Radionuclides*, LA-12981-MS, Los Alamos National Laboratory, August 1995.

8. W. F. Miller, letter to S. L. Kontes, " Radioactive Material Disposition in Exhaust Ducts at TAN-607A," WFM-04-99, May 19, 1999.

9. D. C. Barg, letter to S. L. Kontes, "Transuranic Contamination at TAN-607," DCB-26-99, August 23, 1999.

10. The Butcher Company, Material Safety Data Sheet, "SPEEDBALL Power Cleaner," May, 1993.

11. Babcock & Wilcox Idaho, Inc., TK-GA-102 Sample Report 93L0100066.

12. Babcock & Wilcox Idaho, Inc., TK-GA-102 Sample Report 93L0100067.

13. R. M. Stallman, letter OPE-SMC-99-029 to D. L. Kudsin, "Approval of the TAN-607A Activities Hazard Categorization," October 22, 1999.

14. Hazards Assessment Document (HAD), "Fire Hazards Analysis for TAN-607A," SMC HAD-0047/HAD-42.

15. DOE-STD-1090-99, "Hoisting and Rigging," U.S. Department of Energy, March 1999.

16. INEEL, *Manual 15A, INEEL Radiological Control Manual*, PDR-183, Revision 6, July 6, 2000.

4. SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

4.1 Introduction

The safety analysis in Chapter 3 did not identify any safety class or safety significant structures, systems, or components. The INEEL programmatic controls (e.g. radiation protection, quality assurance) adequately control the activities within this facility.

5. DERIVATION OF ADMINISTRATIVE SAFETY REQUIREMENTS

5.1 Introduction

Administrative Safety Requirements are operational controls that provide protection to workers and the off-site public. According to DOE-ID O 420.D,[1] "Safety Basis Review and Approval," operational safety requirements (OSRs) may be required for moderate and high hazard non-nuclear facilities. The OSRs are contained in DOE approved documents. Since TAN-607A is a low hazard radiological facility, OSRs are not required. However, safety requirements are identified in this chapter as administrative safety requirements to ensure that the facility's radionuclide and hazardous material inventories remain within the limits that define a low hazard radiological facility. The 15 gram limit of U-235 ensures that an inadvertent criticality cannot happen in TAN-607A. Administrative safety requirements do not require DOE approval.

5.2 Administrative Safety Requirements

The following Administrative Safety Requirement is derived from Chapters 3 and 6 of this ASA.

Inventory surveillance shall be performed to ensure that the following limits for a low hazard radiological facility are not exceeded:

- Category 3 threshold limits as listed in DOE-STD-1027-92[2] and LA-12981-MS[3]
- 29 CFR 1910.119 Threshold Quantities and 40 CFR 355 Threshold Planning Quantities
- 15 grams of U-235 or its equivalent, except for the U-235 in natural and depleted uranium.

5.3 References

1. DOE-ID Order 420.D, "Requirements and Guidance for Safety Analysis," U.S. Department of Energy, Idaho Operations Office, July 17, 2000.
2. DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," Change Notice No. 1, September 1997.
3. J. Clow, J. Elder, G. Heindel, W. Inkret, G. Miller, *Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 List of 757 Radionuclides*, LA-12981-MS, Los Alamos National Laboratory, August 1995.

6. PREVENTION OF INADVERTENT CRITICALITY

6.1 Introduction

This chapter presents information relevant to protection against inadvertent criticality during operations at TAN-607A. The requirements for the criticality safety and protection program are contained in the Company Criticality Safety Program Requirements Manual.[1] The Criticality Safety Program requirements are governed by DOE O 420.1[2] and the referenced American National Standards Institute/American Nuclear Society Standards.[3,4] DOE guidelines for non-reactor nuclear facility criticality safety evaluations are provided in DOE-STD-3007-93.[5]

TAN-607A is administratively restricted to contain no more than 15 g of U-235 or its equivalent, which is less than the minimum necessary for a criticality even under optimum conditions of moderation and geometry. Fissile material associated with contamination on equipment in TAN-607A or on equipment brought into the facility is not included in this inventory. The U-235 contained in natural and depleted uranium does not need to be included in this total either (see Reference 1), since in this form it is impossible to form a properly moderated configuration of natural or depleted uranium into a critical mass in TAN-607A. Note, all of the Ducrete and most of the contaminated ductwork, which were the two major sources of U-235 in TAN-607A prior to restoration, have been removed. Therefore, there are no criticality safety issues associated with operations at TAN-607A.

6.2 References

1. Bechtel BWXT Idaho, LLC, *Program Requirements Document For Criticality Safety Program Requirements Manual*, PRD-112, June 1998.

2. DOE O 420.1, Change 2, "Facility Safety," U.S. Department of Energy, August 24, 1996.

3. ANSI/ANS-8.1-1983, R1988, "Nuclear Criticality Safety in Activities with Fissionable Material outside Reactors," American National Standards Institute.

4. ANSI N16.5/ANS-8.7-1975, R1987, "Guide for Nuclear Criticality Safety in the Storage of Fissile Materials," American National Standards Institute.

5. DOE-STD-3007-93, "Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-reactor, Nuclear Facilities," U.S. Department of Energy, November 1993.

7. RADIATION PROTECTION

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

8. HAZARDOUS MATERIAL PROTECTION

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

9. RADIOACTIVE AND HAZARDOUS WASTE MANAGEMENT

9.1 Introduction

The general TAN-607A radioactive and hazardous waste management program is described in Chapter 9 of the TANO SAR[1]. This section outlines waste management activities specific to TAN-607A.

9.2 Requirements

DOE Order 5820.2A, "Radioactive Waste Management," establishes the principal requirements for the management of expected waste from operations at the facilities listed in Section 2 of this ASA.

9.3 Radioactive and Hazardous Waste Management Program and Organization

Waste Generator Services (WGS) is the INEEL's waste management service group responsible for providing onsite and offsite waste generators disposition solutions for both legacy and newly generated wastes. WGS eliminates past waste management problems that occurred because of improper waste handling, multiple organizational interfaces, and poorly defined organization and personnel roles and responsibilities. The WGS personnel at TAN report to the TAN Engineering and Support Services Manager. They provide TAN with turnkey, professional waste management services ensuring compliant, safe, timely, and cost-effective disposition of legacy and newly generated wastes. They also ensure that all treatment, storage, or disposal requirements and waste acceptance criteria are followed and met.

9.4 Radioactive and Hazardous Waste Streams and Sources

Waste generation, handling, and storage operations at TAN-607A are performed in accordance with INEEL waste handling procedures. WGS is charged with the responsibility of handling waste types at TAN. The following summarizes the generation, handling and disposition of wastes and identifies waste streams and sources.

9.4.1 Air Emissions

TAN-607A is equipped with a HEPA filtered ventilation system to reduce emissions, but the system currently is not being used. The HEPA filters are dispositioned per company procedures. Vehicle emissions are generated from transport vehicles and forklift use.

9.4.2 Chemical Use

All chemicals are stored according to applicable INEEL procedures, guidelines, and safety procedures. Material Safety Data Sheets for all chemicals and chemical products used in TAN-607A are available for review as required by 29 CFR 1910.1200 and Management Control Procedure (MCP)-2873, "INEEL Chemical Management System."

9.4.3 Solid Waste

This activity includes providing a waste storage area designated for solid waste. At any one time, this waste stream could potentially include drums of non-hazardous solid waste, batteries, and recyclable materials such as lead.

There is a potential of generating new solid waste from administrative and sampling activities. This waste stream could include personal protective equipment and paper. Potential waste materials would be evaluated before generation for waste minimization and recycling possibilities in accordance with company and DOE policies. All waste would be evaluated and characterized by WGS. All non-hazardous, non-radioactive solid waste would be disposed of at the INEEL Landfill Complex according to the facility's waste acceptance criteria.

9.4.4 Hazardous Waste

The TAN facility's centralized Satellite Accumulation Areas (SAAs) and Temporary Accumulation Areas (TAAs) will be moved to TAN-653 for consolidation and management. These waste streams could include acids, bases, oxidizers, organics, pesticides, inorganics, batteries, used oil, ethylene glycol, circuit boards, and light bulbs (fluorescent and incandescent).

9.4.5 Radioactive Waste

If radioactive wastes are generated, a radioactive waste storage area will be provided in TAN-607A. This waste stream could include radioactive water and solid radioactive waste. The wastes are disposed of according to approved procedures governed by the INEEL RCM[2] and INEL Recyclable Property, Reusable Material and Waste Acceptance Criteria.[3]

9.4.6 Mixed Waste

Centralized SAAs and TAAs for mixed waste storage in TAN-607A will be provided and used primarily for collecting and loading for transport to other facilities.

9.4.7 Radiation Exposure

Radiation exposures will be managed as described in Chapter 7 of SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters*.

9.5 References

1. Safety Analysis Report for Test Area North Operations at the Idaho National Engineering and Environmental Laboratory, INEL-94/0163, Rev. 9, December 2000.

2. INEEL, *Manual 15A, INEEL Radiological Control Manual*, PRD-183, Revision 6, July 6, 2000.

3. DOE/ID-10381, "INEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria," U. S. Department of Energy Idaho Operations Office, August 24, 1995.

10. INITIAL TESTING, IN-SERVICE SURVEILLANCE, AND MAINTENANCE

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

11. OPERATIONAL SAFETY

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

12. PROCEDURES AND TRAINING

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

13. HUMAN FACTORS

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

14. QUALITY ASSURANCE

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

15. EMERGENCY PREPAREDNESS PROGRAM

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

16. PROVISIONS FOR DECONTAMINATION AND DECOMMISSIONING

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)

17. MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL SAFETY PROVISIONS

(This chapter contains general INEEL information. Please refer to SAR-100, *INEEL Standardized Safety Analysis Report (SAR) Chapters.*)